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UPON THE FUNCTION OF THE PSEUDOSTERNITE IN THE ACRIDIIDAE

by C. J. Spencer
University of British Columbia, Vancouver

The tip of the typical male Acridiid abdomen consists of the large, bulbous, up-turned ninth sternum which meets dorsally, the terminal tergite or telson as illustrated in the accompanying diagrams. If this ninth sternum or subgenital plate be depressed, there comes to view a reddish, much-folded membrane, the pallium (Fig. 1.) which in turn conceals the intromittent organ or aedeagus; the aedeagus is composed of two dorsal and two ventral lobes (Fig. 2.) lying in the deeply depressed genital cavity. Cephalad of the aedeagus and still further sunk in the genital cavity, lies a heavily sclerotised plate, the pseudosternite or epiphallus (Figs. 2 and 3, **epi. st.**). The conformation of this structure varies more than any other part of the male genitalia and forms a valuable point for separation of the species of the Acridiidae. Unfortunately, it is so sunk and concealed in the genital cavity, and snaps back into place so readily, that it is difficult to expose even in fresh insects without injuring the surrounding parts, unless the specimens are captured in the act of pursuing females, when the genitalia are often partly extended; in dried specimens it is necessary to make caustic potash preparations necessitating mutilation of the specimen.

This remarkable structure is roughly square or rectangular and carries very variously-formed projections at the four corners; the anterior or cephalic hooks are better developed than the caudal ones which may be poorly developed or wanting. The hooks point latero-cephalad.

I first observed this structure many years ago when working on the homology of insect genitalia and became interested in its function, but could find no reference to it in literature. This note is concerned only with the function of the pseudosternite, which function I determined by watching grasshoppers in the field at mating time, checked by a laboratory study of **Camnula pellucida** Sc. For this study, specimens were collected in coitu in the field, killed in a powerful cyanide bottle, the bodies snipped off behind the meta-legs and the abdomens dehydrated and embedded in wax, still clasped together. A sagittal section was then made with a razor and the relationship of the parts checked. The mating clasp of **camnula** is so strong that some specimens were obtained by stalking a pair mating in the field, snipping off the thorax of the male with a pair of scissors and then before the female could hop away, snipping through her body also; the locked-together abdomens were then dropped into alcohol, and in some cases, remained tightly clasped.

Incidentally, I have often studied the mechanics of egg-laying of **Camnula pellucida** by this method of snipping in two, the bodies of ovipositing females; the thorax hops away with a startled expression indicated by the excited movements of the antennae, while the abdomen remains inserted in the ground, placidly continuing the egg-laying. By grasping one wall of the severed abdomen with forceps and gently lifting it from the ground, the action of the valves when digging and the extrusion of the eggs and froth, can be readily followed. De-

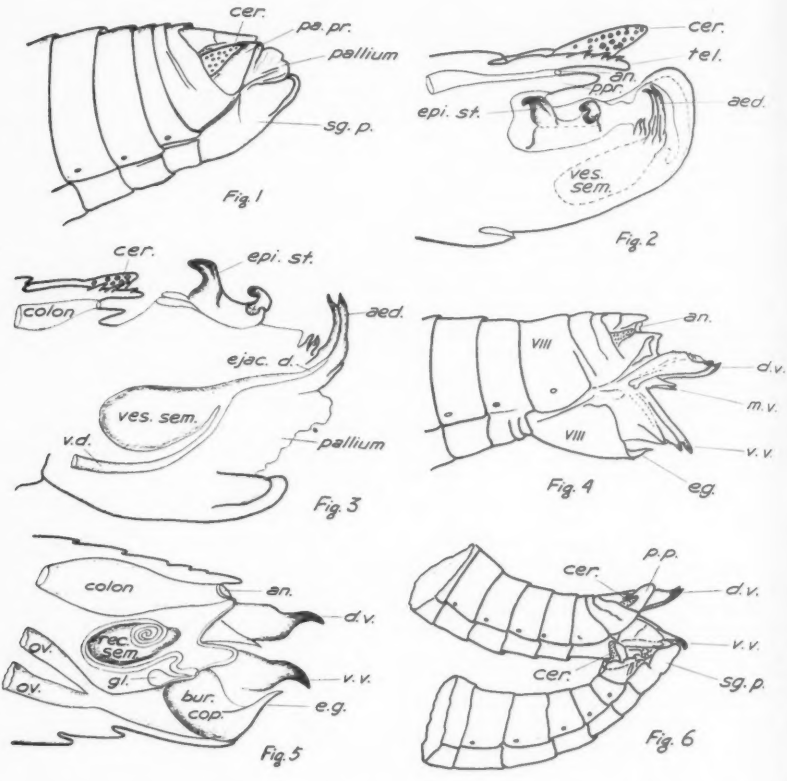


Fig. 1: Male **Acridiid** abdomen slightly opened to show pallium.
Fig. 2: Male. Diagrammatic section to show relationship of parts.
Fig. 3: Details of fully expanded male genitalia.
Fig. 4: Female **Acridiid** abdomen, slightly opened to show external genitalia.
Fig. 5: Female. Diagrammatic section to show relationship of parts.
Fig. 6: Diagram showing mating clasp.

pending upon the number of eggs already laid, the process will continue in the air from two or three minutes to nearly fifteen minutes in extreme cases, before the muscles entirely cease their action or the quota number of eggs has been extruded.

In the field, the function of the pseudosternite is observable only at mating time when excited males are seeking females. At this time males walk around with their abdomens extended, the sub-genital plate depressed and the pallium cover partly withdrawn from the genital cavity. If the male finds a female, he jumps on her, bends his abdomen

to one side of and below hers and endeavors to establish the mating clasp. (The structure of the female abdomen is shown diagrammatically in Figs. 4 and 5). If the female is receptive, the male completely everts the floor of the genital cavity thus exposing the armature of the pseudosternite to the fullest extent, fastens the cephalic hooks of the apparatus around the caudal margin of female sternite VIII and pulls downwards. The hooks fit each side of the egg-guide (Fig. 4 **e.g.**), depress the whole sternite VIII, open the genital chamber or bursa copulatrix (shown partly cut away in Fig. 5 **bur. cop.**) and enable the aedeagus to be inserted into the opening of the receptaculum seminis.

Egg-laying females of **Camnula pellucida** are almost invariably attended by from one to five or six fighting males, one of which establishes the mating clasp immediately after egg-laying is finished and before the female has time to close the egg-laying mechanism (Fig. 6). However, if a female is feeding or has just arrived on the egg bed preparatory to laying, she can close the ovipositor valves and sternite VIII so tightly that no amount of grappling with the pseudosternite hooks will enable the male to establish the mating clasp, although the whole apparatus may be exserted to the full and literally turned inside out. The muscles of this entire structure are apparently in a state of permanent tension and are extended spring-like only at mating time. As soon as the mating clasp is established they return to tension, thus holding the female genitalia in a firm grasp aided, in some species, by the cerci.

INSECTS ATTACKING FOREST PRODUCTS AND SHADE TREES IN WASHINGTON AND OREGON IN 1937

by R. L. Furniss

U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine.

In the course of a year many requests for information concerning the control of insects attacking forest products and shade trees are received at the Portland, Oregon, laboratory of the Division of Forest Insect Investigations. These requests furnish much valuable information relative to the more important pests in these two groups. In addition, records of unusual interest are occasionally obtained from this source. The following discussion summarizes the most noteworthy observations resulting from 91 requests for information concerning insects affecting shade trees and forest products that reached the Portland forest insect laboratory in 1937.

Insects Attacking Forest Products—Inquiries concerning the control of ants, particularly those infesting dwellings, were most numerous. The calls, 24 in all, came in every month except January, February, and December. Sixteen of these calls concerned carpenter ants, **Camponotus. Camponotus maculatus** subsp. **vicinus** Mayr var. was the only carpenter ant definitely identified, although it is probable that **C. laevigatus** (Smith) was also present. In no case was extensive damage noted. These ants prefer to construct their nests in openings between floors and walls; only occasionally do they mine extensively in building timbers. A survey is needed to determine how much dam-

age is done to buildings by carpenter ants in the Pacific Northwest.

Extensive tests are being made at La Grande, Wash., to determine the most effective of the many measures that have been suggested for control of carpenter ants. These tests are inconclusive at present, but they indicate that control of carpenter ants will not be easy under all the conditions that are encountered in infested buildings.

During the middle of September **Lasius niger** var. **sitkaensis** Pergande swarmed abundantly in several dwellings. In each case emergence of the winged forms occurred on warm days over a period of two or three weeks. Upon investigation of the infested dwellings it was found that this ant had constructed its chambers in very moist, rotten wood that had been thoroughly mined by the damp-wood termite **Zootermopsis angusticollis** (Hagen). Control of **Lasius** in these instances could best be effected by eliminating the rot and termites.

Next to ants in the number of requests concerning control, were termites. Thirteen calls were received, all but one of which concerned **Zootermopsis augusticollis.** This insect was observed chiefly in the foundations of houses and in wooden structures, where it was associated with rot in such a way that structural changes were necessary for control of both rot and termites. This relationship between termites and rot has been commonly observed in the Portland area, where the damp-wood termite has only occasionally been found extending its galleries into sound wood.

The subterranean termite **Reticulitermes hesperus** Banks has long been known to occur in the Pacific Northwest, but apparently it does considerably less damage here than it does farther south. For the first time in the past eight years a record of damage in Portland caused by this insect came to our attention. In this instance a small colony was found behind the baseboard in a room under which there was no basement. Little damage had been done.

Four cases of damage by **Lyctus** sp. were reported, two in furniture and two in oak flooring. Although the records of the Portland laboratory do not disclose this to be an important pest in Oregon, it is apparently becoming more abundant.

Hadrobregmus gibbicollis (Lec.) has been reported occasionally as attacking weathered Douglas fir timbers in buildings and bridges in California. The first record of this type of damage in the Pacific Northwest that has come to our attention was on July 30, when William W. Baker, of the laboratory of the Division of Truck Crop and Garden Insect Investigations at Puyallup, Wash., found a heavy infestation in an old, poorly constructed house in that city. An examination of the house on October 15 showed that the entire under portion was so badly infested that replacement of some of the supporting timbers was necessary. Dry, unrotted, Douglas fir wood was attacked. The beetles showed a marked preference for wide grained wood as compared with narrow-grained wood. Sapwood was more seriously affected than heartwood. The extensive damage to this house indicates that **H. gibbicollis** may become a pest of importance in the Pacific Northwest. William G. Mathers, of the Dominion En-

tomologigcal Branch in Vancouver, B. C., has stated in conversation that several infestations of this anobiid have been reported in British Columbia. **H. gibbicollis** is not restricted to coniferous host material. Adults were found on August 6 attacking **Prunus emarginata** near Blaine, Oreg. In June, 1935 it was reared from limbwood of **Acer macrophyllum** that had been collected near Cathlamet, Wash. There are no records at the Portland laboratory of its occurrence on seasoned hardwood products.

Opsimus quadrilineatus Mann. normally breeds in suppressed branches of **Picea, Pseudotsuga, Tsuga,** and **Abies.** However, on March 11 this cerambycid was reported to be causing severe damage to a rustic house in the Mount Hood recreational area. Adults were reared from riddled Douglas fir wood taken from a window casing in this house. The owner stated that infestation extended throughout the building, which was built seven or eight years ago. So far as the workers at the Portland laboratory know, **O. quadrilineatus** had not previously been recorded as a pest of seasoned-wood products.

Inquiries are received year after year concerning the emergence holes of **Buprestis aurulenta** L. and **B. langii** Mann. in Douglas fir in buildings, particularly in flooring and siding. Although there are many authentic records of greatly retarded development of these buprestid borers in seasoned-wood products, it does not necessarily follow that all beetles emerging from buildings have been in them ever since they were erected. It is likely that in the Douglas fir region where these insects are native they may deposit eggs and rear broods in lumber after it has become part of a building. Early in July **B. langii** emerged in numbers from a large Douglas fir timber that had been in use for 11 years on the municipal docks in Vancouver, Wash..

Polycaon stoutii (Lec.) is a native of California and southern Oregon that frequently reaches the Northwest in shipments of furniture. The insect is most often found in the filler layer of plywood, where it may remain unnoticed for years. Four reports of damage to furniture by this bostrichid were received in 1937. In an instance reported from Hoquiam, Wash., February 27, an adult emerged through the top of a hardwood table that had been in use for 10 years.

Callidium antennatum hesperum Casey commonly infests ponderosa pine lumber on which considerable wane has been left. On May 17 adults of this cerambycid emerged from the walls of a log cabin in Lakeview, Oregon. The numerous larvae had been discovered from the sound of their boring and from piles of borings on the floor of the cabin.

Prionus californicus Motsch. prefers to feed in the roots of deciduous trees but also attacks conifers. In February several large larvae were taken from decaying bridge timbers of Douglas fir in Portland.

Insects Attacking Shade Trees—Cryptorhynchus lapathi (L.), the poplar and willow borer, has become thoroughly established on native willows near Portland and in many other localities in Oregon and in Washington. Our first record of **C. lapathi** in Oregon was in July 1933,

when J. A. Beal, then of the Portland laboratory, found it heavily infesting willows along the Willamette River. Several years earlier other entomologists had found it in Washington and British Columbia. In 1937 four home owners reported the insect on ornamental willows near Portland. Apparently it is gradually extending its range southward in the Willamette Valley.

Outbreaks of **Galerucella xanthomelaena** (Schr.), the elm leaf beetle, occur in Portland nearly every year. Infestation was exceptionally heavy in 1936, owing to a slackening of control effort the previous year, but was materially reduced in 1937 by an intensive spraying program conducted by the city park bureau.

In September mature grand firs on a country estate near Salem, Oregon, were noted to be heavily infested with **Adelges piceae** (Ratz.). The infestation on these trees is known to have existed since 1932 and is gradually weakening the firs. It causes deformation of the leaf buds and a thinning of the foliage, particularly on the lower branches.

Late in April **Adelges tsugae** Ann. was found to be killing the shaded lower branches of a western hemlock hedge in Portland.

Infestation by the satin moth, **Stilpnotia salicis** (L.), in Washington was light in 1937 in nearly all of the old centers. The introduced parasites **Meteorus versicolor** (Wesm.), **Apanteles solitarius** (Ratz.), and **Compsilura concinnata** (Meig.), are abundantly established and apparently are effectively controlling this pest. A native parasite, **Tachinomyia similis** (Will.), has successfully established itself upon **S. salicis.** Early in July, wilt was noted as a factor of importance in killing nearly full-grown satin moth larvae in Tacoma. Extensive scouting in the Rogue River drainage of southern Oregon failed to reveal the satin moth in that area. **Apanteles solitarius** was recovered in Oregon for the first time, when adults were reared in June from satin moth larvae collected near Gervais.

QUARANTINE REGULATIONS IN RELATION TO EXPORTS

by H. F. Olds
Plant Inspection Office, Entomological Branch,
Canada Department of Agriculture, Vancouver, B. C.

To an agricultural country like Canada, where production exceeds its home consumption by about fifty percent, the value of her export markets cannot be over-estimated, and if we are to hold our present markets and gain new, every effort must be put forth to protect these markets by just as rigid an inspection of all our exports as we would make on imports.

During the past few years this export trade has been gradually increasiing. Just to mention a few special lines of exports from British Columbia—during this past year approximately ten thousand rose bushes, twenty-four hundred rhododendron shrubs and over one million bulbous iris were exported. Our fresh fruit exports have also increased. British Columbia produced in apples over five and one-half million

boxes this year, a large percentage of which must find its way to foreign markets. These items mentioned are only a few lines of our agricultural production in this province, and certainly only a small percentage of the total agricultural production of Canada. About half of Canada's population of approximately eleven million derive their livelihood from agriculture in one form or another, and as about fifty percent of our production is exported we can readily see how important it is that the regulations of the importing countries are complied with, not only in quality and attractiveness, but also in freedom from pests and diseases.

With the rapid advancement made in transportation facilities world markets have been made available. For instance, we are shipping fresh apples to Palestine and importing their fresh citrus fruits, so that with this improvement in transportation, plants or plant products may be exported or imported from practically any part of the world, and with the exchange of these products we have increased the possibilities of introducing new pests and diseases.

Our Department has to date summarized the plant legislation of 219 countries (including territorial possessions) in order that the exporter and grower might obtain this information. Today we have 81 countries (26 empire and 55 non-empire) which require an accompanying certificate of health with apples, 75 countries (23 empire and 52 non-empire) requiring certification for vegetables and 120 countries (39 empire and 81 non-empire) requiring certification for potatoes. Apart from these, we inspect and certify all consignments of nursery stock for all countries.

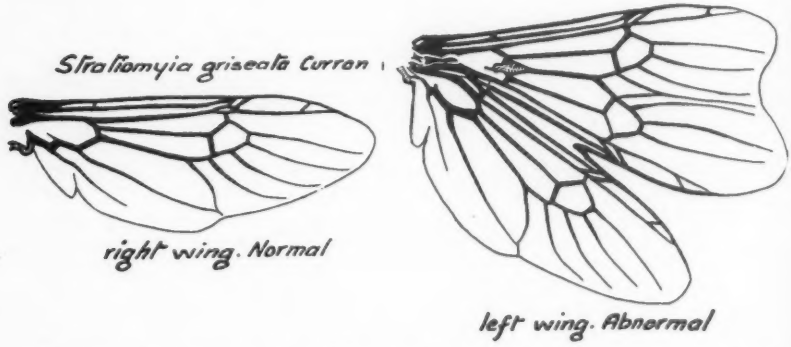
The Canadian Department of Agriculture has become a very vital institution in the agricultural life of Canada. Through the years its responsibilities have been constantly augmented and its activities have become more diversified. Every phase of Canada's agricultural industry is more or less affected by the work of this Department, but to make this work fully effective the importance of having all officers of the Department acquainted with the major activities which are being carried on in the varous branches of the service can scarcely be overestimated if we are to be able to intelligently direct public inquiries into the proper channels.

This paper might not be considered of a strictly entomological nature, but as the pest control work which is being carried on in the province by the entomological staff in the field and our activities are so interlocked and dependent on each other, particularly in relation to exports, I felt that this paper would not be out of place.

A TRIPLE STRATIOMYID WING

by G. J. Spencer
University of British Columbia, Vancouver

On the hills around Kamloops, just below the timber line, which is here only about 3,100 feet to 3,400 feet, stretches a belt of the Range Sunflower, **Balsamorhiza sagittata** Nuttal. On gentle slopes, this belt is sometimes one half mile wide and thins out near and below the 2,700 foot elevation. The early part of summer 1937 produced unusually luxurious vegetation in this belt, the **Balsamorhiza** especially making a brilliant show.



During the last week in May and the first week in June, large numbers of insects hid for the night under the broad sunflower leaves, chiefly Chironomids, and the big soldier fly **Stratiomyia griseata** Curran. This fly is fast enough on the wing in bright sunlight, is seldom seen and is hard to catch, but at dusk it can be picked off sunflower leaves by hand and I collected a few dozen including one which had seemingly a deformed left wing. On examination, this wing proved to be a triple affair consisting of two nearly complete wings facing each other and fused on the anal margin, and a complete third wing caudad to the first part, fused half way up the costal margin and bent partly ventrad of the first portion. (as per sketch).

It is difficult to make out the details of the pleural sclerites supporting this abnormality without clearing the body wall in caustic, thus destroyiing the fly, but the basal portions of all the veins are so complete that I suspect the sclerites also are at least partially in triplicate.

For the moment I am interested in the forces that produced this peculiarity—was it a result of injury to the wing bud or a triplication of the genes controlling the wing? We have only the work done on **Drosophila melanogaster** to guide us in this search and in this insect the inheritance of over 500 distinct characters has been traced to genes which are inherited according to the Mendelian principle of segregation. The nearest approach to anything like this freak wing, that I can find in **Drosophila** is in the second of the four character groups where the last gene of the IInd Chromosome, 107.5, is responsible for the

"balloon" or greatly expanded wing. It is also conceivable that the characters 58.7 and 59.5 of the IIIrd Chromosome yielding the "bithorax" may have developed into a tri-thorax and yielded a triple wing. But why on one side only? Except for these two points, I can find no gene that is responsible for a replication of features; all the others produce a change of some sort, morphologically, or only a color change.

Acknowledgement

I am indebted to Dr. G. E. Shewell of the Division of Entomology, Ottawa, for giving me the specific name of this fly.

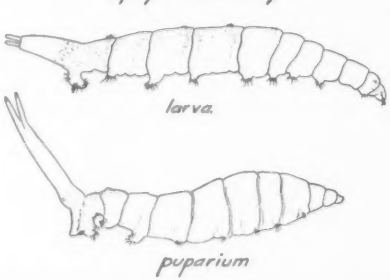
It is of interest to note that up to the time of my sending specimens for identification, the only ones in the National Collection were the type and paratype; in the summer of 1937 thousands of these flies occurred on the Kamloops hills. The summer of 1938 was very dry, **Balsamorhiza** had dried up by the time I arrived and the flies were entirely absent.

A NOTE ON BRINE FLIES IN BRITISH COLUMBIA
(Ephydridae: Diptera)

by Ivor J. Ward

Science Service, Dominion Department of Agriculture

In various parts of the area north of Clinton, B.C., such as east of 100-Mile House on the Cariboo Road and westwards along the Chasm-Jesmond road, occur several so-called soda lakes whose white crystalline shores are conspicuous as far as they can be seen. In several instances the deposits from these lakes have been harvested as commercial ventures and the remains of loading machinery and wharves may still be seen, heavily encrusted with white crystals.



One such lake occurs along the road leading from past Carr's Ranch towards Canoe Creek. The lake is apparently subject to considerable fluctuations in level over periods of years because it was once very low and encircled by trees, then some ten feet higher, and the salt killed the trees; at present it is low again and dead trunks stick out from the edges of the alkali like sentinels, heavily encrusted with white crystals.

Passing by this lake on August 25th, 1937, in company with Mr. J. K. Jacob, who was collecting Diptera at the moment, we noticed that

the masses of crystalizing salt on the edges of the "thick" water and especially the damp masses of salt all over the timbers of the abandoned elevators and chutes, were plastered with puparia of a brine fly; the small amount of water that occurred between the chunks of salt in a state of almost supersaturation, was thick with wriggling larvae. Over the whole white shore line, over the masses of salt and even on the surface of the water, moved a swarm of small flies.

This is the so-called Brine Fly, **Ephydra hians** Say of the family Ephydridae, whose members are sometimes very common around marshes and decaying swamps. This species is dark gray with a greenish front and is considerably larger than the average for the family. Aldrich records that its larvae occur in such vast numbers in Mexico that the Indians used to collect them for food known as Koo-tsabe. It has since been recorded in literature several times from the Western States.

As far as I can determine it has not hitherto been brought to the notice of this Society and since it is of such unusual habitat and is so enormously plentiful in these Cariboo lakes, I have prepared this note about it. If Entomologists have not mentioned it in this Province, those engaged in the commercial extraction of soda have commented on it for many years. Specimens were sent down from this area in 1926 to the University for identification, along with a large mass of crystals and empty puparia. When the salt was diluted down and filtered, a surprising amount of minute globular bodies, probably algae, was obtained which were not normally noticeable among the salt crystals. Chemists who analyzed the deposits at the time, observed and remarked on these flies.

On account of its remarkable habitat, the insect is of considerable interest. The tiny, white, curved eggs of allied species (so probably of this species) are laid directly in the brine and the larvae develop entirely in this medium which Dr. W. Seyer of the department of Chemistry at the University informs me, is 99.5 percent pure sodium carbonate, practically in a saturated condition, with traces of other salts making up one half of one percent. Early stages of the larvae are not to hand but the mature maggots are of unusual shape. The segments are equipped with prolegs, tipped with double sets of claw-like, short setae. The two posterior pairs are opposable, forming an effective grasping mechanism. There is a caudal breathing extension, terminated by two short and apparently extrusible, finger-like respiratory processes from which two tracheae run forward to about the middle of the body. (See accompanying sketch). The mouth hooks are typically dipterous and the question arises as to the food of these maggots. They cannot subsist upon pure sodium carbonate! From examination of the stomach contents, Mr. Spencer has suggested that the larvae may feed upon the globular algae so abundant in the brine and that this feeding is effected by the larvae grasping the algae with the anal pro-legs and rasping it with the mouth hooks. I have had no opportunity of checking this suggestion.

The puparium is but little changed from the mature larva except that the anal extension is nearly doubled in length and the finger-like projections are longer and are permanently protruded. Pupae may of-

ten be seen attached to particles of wood or even to the breathing tubes of one another, by the grasping mechanism of the anal pro-legs.

Acknowledgement

I am indebted to Professor G. Spencer for certain assistance with this paper and for getting the analysis of the salt from Dr. Seyer.

Also to Dr. G. E. Shewell of the Division of Entomology at Ottawa for verifying our tentative identification of this fly.

A PRELIMINARY LIST OF THE BIBIONIDAE OF BRITISH COLUMBIA AND SOME LOCALITY RECORDS

by J. K. Jacob
Vancouver, B.C.

The **Bibionidae** or March flies are slender flies of small to medium size. The adults are frequently very common, sometimes being attracted to blossoming fruit trees, particularly the Pomes. The name "March flies" has been given the family in this country because of the frequent occurrence of some species in large numbers during the month of March, at which time they attract considerable attention.

The very primitive larvae are dark colored, tough, and with well developed heads. They are often gregarious and feed on decaying vegetable matter, manure, or on the roots of grasses, grains, vegetables, and other plants.

Until very recently little systematic work in North America has been done on the Bibionidae. The first notable effort was made by W. L. McAtee in 1921. Later, in 1936, M. T. James published a paper entitled "Some New Western Bibionidae." A large number of short papers have also been published in recent years. During the last two years a complete revision of the known North American Bibionidae has been made by D. E. Hardy of the Utah Agricultural College from which much of the material for this paper was taken.

The family is separated from all other Dipterous families by the following characters: antennae composed of eight to twelve segments and placed below the compound eyes, usually close to the oral margin; eyes separated; ocelli present; mesonotal suture transverse; costa vein ends at or near the wing tip; discal cell absent; tibial apical spurs present.

Characters of wing venation and of the tibiae are used in separating the genera. Of the seven genera listed in Curran's "North American Diptera" six are recorded for British Columbia.

In this list there are recorded 30 species and 5 varieties together with their distribution. The records are those of numerous collectors and were obtained principally from the Canadian National Museum, D. E. Hardy, C. Garrett, the University of British Columbia and my own collections. Therefore few of the specimens whose records are listed below are in my own or in the University collection.

I wish to thank especially Mr. G. E. Shewell of the Division of

Systematic Entomology at Ottawa and Mr. D. E. Hardy of Utah State Agricultural College for determinations and records.

Order **Diptera.**

Family **Bibionidae.**

Bibiodes aestiva Mel.—Summerland.

Bibio albipennis Say—Agassiz, Creston, Kaslo, Lillooet, Minnie Lake, Oliver, Royal Oak, Saanich, Salmon Arm, Vernon, Victoria.

Bibio albipennis hirtus Lw.—Penticton, Niskonlith Lake, Pt. Roberts, Vancouver.

Bibio albipennis Say verging toward **afer** McAtee—Niskonlith Lake.

Bibio afer McAtee—Agassiz, Vancouver.

Bibio basalis Lw—Seton Lake, Cranbrook.

Bibio columbiaensis Hardy—Jesmond.

Bibio currani Hardy (**Bibio lacteipennis** Curran)—Ground Hog Basin, Revelstoke Mtn.

Bibio currani nigrita Curran—Revelstoke Mtn.

Bibio femoratus Wied.—Copper Mtn.

Bibio fluginata Hardy—Salmon Arm.

Bibio fumipennis Wlk.—Barkerville.

Bibio hirtus Lw. (See Note 1.)—Agassiz, Aspen Grove, Boswell, Gordon Head, Kamloops, Kootenay Flats, Lillooet, Minnie Lake, Oliver, Royal Oak, Saanich, Vancouver, Victoria.

Bibio holti McAtee—Yahk.

Bibio inaequalis (See Note 4.)

Bibio jacobi Hardy—Dunn Pk.

Bibio rufitibialis Hardy—Dunn Pk.

Bibio labradorensis Johns.—Hedley.

Bibio nervosus Lw.—Cranbrook, Kaslo, Laggan, Lac du Bois (Kamloops), Penticton, Revelstoke, Royal Oak, Vancouver, Vernon.

Bibio nigrifemoratus Hardy—Monte Lake.

Bibio sericata Hardy—Cranbrook, Hedley, Oliver, Yahk.

Bibio signatus Hardy—Revelstoke, Vancouver.

Bibio slossonae Cock—Cranbrook, Haney, Hazelton, Summerland.

Bibio variabilis Lw.—Agassiz, Alta Lake, Copper Mtn., Kaslo, Pender Harbour, Penticton, Prince Rupert, Revelstoke, Ucluelet, Vancouver, Victoria.

Bibio xanthopus Wied.—Courtney, Jesmond, Kamloops, Vancouver.

Bibio xanthopus palliatus McAtee—Vancouver.

Bibio—a species near **kansensis** James—Vernon.

Philia Meigen 1800 (**Dilophus** Meigen 1803).

Philia caurinus McAtee—Agassiz, Jesmond, Kaslo, Keremeos, Minnie Lake, Nanaimo, Revelstoke, Saanich, Salmon Arm, Sicamous, Vancouver, Victoria, Cranbrook.

Philia obesulus Lw.—Glacier.

Philia serotinus Loew. (See Note 4.)

Philia stigmaterus Say—Mt. Cheam, Vancouver, Fernie.

Philia tibialis Lw.—Cranbrook, Crows Nest, Banff, Keremeos, Michel, Oliver.

Hesperium brevifrons Wlk. (See Note 2.)

Plecia heteroptera Say (See Note 2.)

Cramptonomyia spenceri Alex. (See Note 3.)—Langley Prairie, Vancouver.

Note 1: In McAtee's "Notes on Nearctic Bibionidae" (1921) this species appears as **Bibio hirtus** Lw. Specimens in the Canadian National Museum are so labelled. The specimens in my collection were labelled **Bibio albipennis hirtus** Lw. Whether this is a change in nomenclature and whether they are two distinct species I have not been able to find out. Hardy does not refer to **B. hirtus** at all.

Note 2: The two species **Hesperium brevifrons** Wlk. and **Plecia heteroptera** Say are believed to be present in this province but owing to the difficulty of obtaining certain obscure records they still remain as doubtful records.

Note 3: In a previous paper of mine (1937) this species was placed in the Bibionidae on information received from Dr. C. P. Alexander. Since then Alexander has placed it in the family Pachyneuridae in which **Cramptonomyia** resembles certain genera more closely than genera in the Bibionidae. Another species of this genus has recently been described from Japan.

Note 4: **Bibio inaequalis** and **B. serotinus.** As specimens of these two species were not returned to me after being identified I am unable to give their distributional data.

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ECTOPARASITES OF DEER IN BRITISH COLUMBIA

by G. J. Spencer
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Acknowledgements

I am very grateful to Dr. J. Bequaert, Harvard School of Tropical Medicine, for checking my tentative naming of the louse flies and to Mr. Harold Peters, Wild Life Survey, Alabama Polytechnic Institute, Auburn, for settling the puzzling question of the identity of the Mallophaga on the deer in this Province.

There are three species of deer in British Columbia whose identity and range is briefly as follows:-

1. The Coast deer or Columbia Black-Tailed deer **Odocoileus**

columbianus columbianus (Richardson) inhabiting the islands off the coast and the mainland eastwards to the summit of the Cascade Range.

2. The Mule deer, **Odocoileus hemionus hemionus** (Rafinesque) occurring in the Dry Belt, from the summit of the Cascades eastwards to the Kootenay country.

3. The White-tailed deer, **Odocoileus virginianus macrourus** (Rafinesque) extending from the Kootenay country, eastwards. An antler of a white-tail was picked up by Dr. R. Bird of Manitoba in 1933, on the south side of Marble Canyon which extends from Hat Creek to Pavilion, so at least a colony of white-tailed deer occurs well to the west of the Dry Belt which is typical Mule deer territory. (The animal may have been a straggler and not one of a colony.)

Hybrids occur between the Coast deer and the Mule deer but they are not common and are usually limited to the boundary line between the territory occupied by these species, as at Pemberton Meadows where several have been taken. I have several times been assured that the white-tail occurs on the coast and on Vancouver Island but the white-tail of the hunter, prospector and surveyor is apparently not the white-tail of the biologist. We may therefore be safe in considering that a deer shot at the coast is a Black-tail, one taken in the Dry Belt is a Mule deer and one taken in the eastern part of the Province, a White-tail.

Of the Black-tails, those on Vancouver Island and most of the Gulf Islands are smaller than those on the mainland and those on islands like Texada and Lasqueti which are some distance from the mainland, have inter-bred until they are such small animals that a man can carry one on his shoulders without much effort; whereas a fat mule deer buck of the Dry Belt will weigh as much as 300 lbs.

For the past few years I have collected parasites of deer whenever opportunity arose and it seems that these small island forms and the sickly ones of other regions, are most infested with parasites whereas large, fat, healthy specimens will be relatively free.

The best time for collecting parasites from all mammals, including deer, seems to be early spring when the severity or inclemency of winter has taxed the strength of the hosts. Later in summer parasites tend to disappear, except on weak animals.

Although most of my collections have been made from male animals owing to hunting regulations, both sexes seem to be equally infested and of the body itself, the back seems to be most attacked, though this varies with the time of the year, when the flank and inside of the thighs may be preferred. It is on the back that lice lay their eggs.

I have taken the following parasites from deer: louse flies, biting lice, a few sucking lice and a few mites; never any fleas. The process of searching for them is a laborious one—the thick, coarse hairs have to be parted systematically a few at a time, with a pair of forceps. Louse flies are readily found but lice are exceedingly difficult to locate, never coming to the surface upon the death of the host, but remaining

close to the skin. Biting lice attach by their mandibles, sucking lice by their claws. When lice are scarce on a deer, it may take one or two hours to go over the hide before locating any.

Concerning HIPPOBOSCIDAE

In order of their occurrence and frequency, the louse flies are easily first. Every deer hide or head I have examined, has contained these flies and many more have been sent in to me from widely scattered points. The vast majority of them are **Lipoptena depressa** (Say) which is freely and generally distributed all over the coast region while in the Interior **Lipoptena ferrisi** Beq. (**subulata** F. & C.) seems to be the commonly-occurring Species. On only two occasoins have I found **L. ferrisi** Beq. on the coast and then only four specimens.

Disregarding several small collections of only a few specimens, the following table gives a summary of some collections. The predominance of females, roughly 2.6 times that of males, may be due to the larger size of the former and the greater alacrity of the latter. The distribution of the species, **L. depressa** on the coast and **L. ferrisi** in the Interior, may be either a host relationship or a climatic one—probably the latter.

Some Records of Hippoboscidae From Deer

Columbia Black tailed Deer	**L. depressa**		**L. ferrisi**	
North end Vanc. Is. (prob. Alice Arm) Sept. 1929. W. R. W. coll.	21	15	2	1
Sooke area. Vanc. Is. 20 Oct. 1929. L. Peden	3	14		
Howe Sound. Vanc. region. G. J. S.		37		
Comox. Vanc. Is. 9 Nov. 1930 I. McT. C.	4	56		
Englishman R. Vanc. Is. 1 Nov. 1931. W.R.W. (Three winged)	11	1		
Lasqueti Is. Straits of Georgia. Spring 1932. R. Oben	1	1		
Campbell R. Vanc. Is. Nov. 1937. G. J. S.	30	51	1	0
Pemberton Meadows. Coast. Nov. 1937 G. J. S. From area of Coast deer-Mule deer hybrids			7	4
Mule Deer:				
Kamloops, B. C. Nov. 1933. J. S. Keyes			0	26
	70	175	10	31
	245		41	
Total	286			

So far I have been unable to formulate any rule for the breeding periods of these flies because young flat females may be present at the same time as heavily gravid, large ones. Of the 51 females of **L. depressa** taken from the Scalp (only) of the Campbell River deer in November, 1937, several were in all stages of reproduction. Of the 4 females of **L. ferrisi** from the Pemberton Meadows deer of November

1937, one showed a very young larva with the beginning of a capitulum. From these two records at least, it seems that young flies probably emerge at intervals throughout the spring.

With the exception of only two collections when winged ones were present, all these louse flies had the wings broken off at the humeral suture.

As far as injury to the host is concerned, I have not yet seen a puncture mark on the skin of a deer, even in cases of heavy infestation. This is in marked contrast to the effects of lice and mites on rodents where extensive feeding punctures show on the skins of the hosts. In some cases, even on the thick skins of ground-hogs, severe feeding scars may occur.

Concerning the ANOPLURA, the only species I have is **Solenopotes ferrisi** (Fahrenholz) [**Cervophthirius crassicornis** (Nitzsch)] of which I have only three specimens, one from a deer at Eagle River, east of Revelstoke, and two from a deer at Comox, Vancouver Island. On this latter animal, both biting and sucking lice occurred.

In general, it may be said that sucking lice are rare on deer in this Province, unless my examinations have been made at the wrong season or from the wrong portions of the province, for these insects.

Concerning MALLOPHAGA, however, it is a very different matter. From Osborn's time up to the present, confusion has reigned over species of **Tricholipeurus** (Trichodectes) from deer owing, I think, to the very incomplete collections from which the naming has been done. Osborn named **parallelus** from only 3 females which I think were immature although the species is valid and McGregor named **odocoilei** from only three specimens, and McGregor's species is not valid but a synonym of **parallelus** Osb. (Peters, in correspondence).

I forwarded Mr. Harold Peters, (at the time with the Bureau of Entomology) nine collections of 157 specimens and he was able to clear up the uncertainties concerning these lice.

Some Records of Mallophaga From Deer

	Tricholipeurus	
Columbia Black Tailed Deer	**parallelus**	**virginianus**
Mt. Lehman, near Abbotsford, May 22, 1910. S. Hadwen. Specimens loaned by Prof. A. Baker, Guelph	15	
Howe Sound, Vanc. district, Dec. 29, 1929. G.J.S.		6
Campbell R., Vanc. Is. Nov. 19, 1933. G. J. S.		18
Comox, Vanc. Is. Nov. 9, 1930. I. McT. C.		5
Mule Deer		
Quesnel, B.C., May 18, 1932. I. McT. C.	18	
Quesnel, B.C., May 19, 1932. I. McT. C.	88	
North Fork Eagle R., near Revelstoke, May 22, 1932. E. R. B.	6	2
Vavenby, B.C., North Thompson R. 1934. T.K.M.		10
	127	41
Total	168	

The last record from Vavenby, "in spring", showed all females—both

nymphs and adults, the latter among the largest I have seen being 2.7 m.m. long. Eggs were also present showing that breeding was actively progressing. The lice came from a strip of skin cut from the saddle. I have a later record from Vavenby, of a small piece of hide some 2 inches long, left on the spines of a barbed wire fence that deer had jumped. The hide was covered with fine white hairs showing that it had come from the belly or inside of a thigh and lice were common on it. Several later collections are to hand but have not been analyzed.

The species **Tricholipeurus virginianus** was named by Mr. Peters from the eastern White Tailed deer. In a letter to me he says "It is extremely interesting to me to find my deer louse so widely distributed and so common, especially on deer in eastern United States." In the same letter he sinks the name **T. odocoilei** McGregor as a synonym of **T. parallelus** Osborn.

In conclusion, deer in this Province commonly harbour two species of Louse flies, two species of Biting lice and very rarely, one species of sucking louse, besides ticks and mites which are not considered here.

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A PRELIMINARY LIST OF STONEFLIES (PLECOPTERA) FROM THE VICINITY OF CULTUS LAKE, BRITISH COLUMBIA

by William E. Ricker

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Fisheries Research Board of Canada

Cultus Lake is situated on the southwestern mainland of British Columbia, about 35 miles from salt water, and 4 miles north of the International boundary, in latitude 49° 4′ N., longitude 122° 0′ W. The level of the lake is only 50 meters above sea-level, but it lies between the two western-most outliers of mountain ranges which in the near vicinity rise to elevations in excess of 2,000 meters. To the north lies a broad valley traversed by the Fraser river, and its tributary the Sumas-Chilliwack system. Specimens of stoneflies recorded in this paper were taken within an area bounded by the Fraser river on the north; the Sumas and Chilliwack rivers, Sweltzer creek, Cultus lake and their tributaries on the west; Tamihi creek on the east; and the North Fork of the Nooksack river on the south. The more southerly part of the region outlined lies in the state of Washington.

Within this region collections were made at a variety of locations. The habitats sampled may be grouped as follows:

(1) Large rivers at base-level, near the border of the region of tidal influence: the Fraser and the Sumas.

(2) Large cold rivers at low elevation, with beds mostly of loose boulders rolled along in every major flood: the Chilliwack (or Vedder) at Vedder Crossing, the Nooksack above the falls.

(3) Medium-sized cold rivers at low elevation, having more stable bottoms than the above: Lower Liumchin creek, Frost creek.

(4) Medium-sized warm rivers at low elevation: Sweltzer creek, the outlet stream of Cultus lake. Its summer temperature commonly passes 21° C., when other medium-to-large streams of the region probably rarely exceed 16°.

(5) Small cold creeks at low elevation: Hatchery, Reservoir, Ascaphus, Dumvill, Smith Falls, and Watt creeks, all tributary to Cultus lake; Spring Brook on Liumchin trail near the lake.

(6) Medium-sized cold rivers at moderate elevation (about 1,000 meters): Little Liumchin creek (about 350 meters below Liumchin lake); Canyon creek north of Glacier, Wn., where the Forest Service trail meets it; Tamihi creek, about 5 miles from its confluence with the Chilliwack river.

(7) Small cold creeks at moderate elevation: Calypso and Cornuta creeks near Canyon creek, on the trail.

(8) Small cold creeks at high elevations (over 1,500 meters): Saxifrage creek, main tributary of Liumchin lake; Boundary creek, on International boundary just west of monument 48.

Most collecting was done on the Chilliwack river, Sweltzer creek, and the small creeks close to Cultus lake. No type of habitat has been exhaustively studied, but the streams at moderate to high elevations, plus the great Fraser river, will probably yield the greatest amount of new information to future collecting.

Plecoptera being a little-studied order of insects, the fauna of British Columbia and Washington is at present poorly known. Prior to 1925 only scattered records had been published, principally by Professor Nathan Banks. These were summarized in Needham and Claassen's Monograph of that year, and many new records added. Even so, their total list was only 27 species from B. C. and 30 from Washington, a total of 45. Since the time of the Monograph, there have been a number of contributions to the study of the region. Prof. Ferris Neave of Winnipeg has added a number of new records, some of new species, and has also made extensive collections in the Jasper region just outside of B.C. Dr. T. H. Frison of Urbana has likewise recorded a few species from B.C., and a new one from Washington. He has also published several valuable papers on Oregon material, including many new species now found at Cultus lake. The British Columbia list now stands at 42 species, and the combined B.C. and Washington list at 60—but it is probable that a few duplications are present in this total.

Neither British Columbia nor Washington, however, has had a resident collector who gave special attention to Plecoptera—or at least, the results of such collecting have not been published. Consequently no single locality or geographical region has been collected with any approach to thoroughness. The writer's effort to remedy this situa-

tion, as regards a site in the southern coastal rain-forest region, have had very encouraging results. The number of described species taken, and recognized, in the limited region outlined above, is 52; and of these 25 are recorded from British Columbia for the first time. In addition, 8 undescribed species have been taken, and about 20 which cannot as yet be definitely placed, either because of inadequate material, or lack of facilities for comparing them with types of similar or possibly identical forms. Determinations have been checked in some cases by the late Dr. P. W. Claassen of Cornell University, and in most cases by Dr. T. H. Frison of the Natural History Survey of Illinois, to whom our appreciation is here extended.

In the list to follow, the types of habitats in which each species has been taken to date are indicated, together with some idea of its abundance, or at least of its availability to the collector. Unless otherwise mentioned, records have been obtained from both British Columbia and Washington. Specimens of species marked with a star (*) have been compared with their type by their describer.

Abbreviations used are as follows: A—abundant; C—common; FC—fairly common; R—rare; Chwk.—Chilliwack; r.—river; ck.—creek.

PTERONARCIDAE

(1) **Pteronarcys carifornica** Walker. Chwk. r. and Sweltzer ck. (C). (B. C. only).

(2) **Pteronarcys princeps** Banks. Small to medium-sized cold cks. (A).

PELTOPERLIDAE

(3) **Peltoperla brevis** Banks. Small cks. at low elevation. (A). (B.C. only).

TAENIOPTERYGIDAE

(4) **Taenionema nigripennis** Banks. Large streams. (FC).

(5) **Taenionema pacifica** Banks. Fraser r. (A). (B.C. only).

(6) **Doddsia occidentalis** Banks. Large to medium cold streams, up to moderate elevations. (A).

NEMOURIDAE

(7) **Nemoura cataractae** Neave. Saxifrage ck. (FC). (B. C. only).

(8) **N. cinctipes** Banks. Sweltzer ck. (A); small cold cks. (FC); large rs. (R).

(9) **N. columbiana** Claassen. Moderate to high elevations. (C). (B.C. only).

(10) **N. completa** Walker (syn. **N. glabra** Claassen). Medium to large cold streams at low elevation. (A).

(11) **N. cornuta** Claassen. Small cold cks. up to moderate elevations. (C)..

(12) ***N. dimicki** Frison. One small ck. (FC). (B.C. only).

(13) **N. interrupta** Claassen. Small cks. at low to moderate elevation. (C).

(14) ***N. lobata** Frison. Small cold cks. (A); larger streams. (FC). (B. C. only).

(15) ***N. oregonensis** Claassen. Generally distributed at all elevations; small cks. (A).

(16) ***N. producta** Claassen (syn. **N. tuberculifera** Frison). Small to medium cold cks. at low to moderate elevation. (C).

LEUCTRIDAE

(17) **Leuctra bradleyi** Claassen. Small cks. at all elevations. (A); large streams. (FC).
(18) ***L. glabra** Claassen. Small cks. at all elevations. (A).
(19) ***L. infuscata** Claassen. With the last. (A).
(20) **L. occidentalis** Banks. Small cks. (A); larger streams (C); at low elevations.
(21) **Perlomyia utahensis** Needham and Claassen. Chwk. r. (FC). (B. C. only).
(22) ***P. solitaria** Frison. Chwk. r. (C). (B. C. only).

CAPNIIDAE

(23) **Capnia columbiana** Claassen. Fraser r. (FC). (B. C. only).
(24) **C. elongata** Claassen. Large rs. (A).
(25) **C. excavata** Claassen. Large rs. (C). (B. C. only).
(26) ***C. gracilaria** Claassen. Sweltzer ck. (A); large cold rs. (R). (B. C. only).
(27) **C. oenone** Neave. Frost ck. (A). (B. C. only).
(28) **Isocapnia fumigata** Claassen. Fraser, Chwk. & Nooksack rs. (C).
(29) **Eucapnopsis brevicauda** Claassen. Medium to large streams at low elevation. (A). (B. C. only).

PERLIDAE

(30) **Acroneuria californica** Banks. Small to medium cold streams at low elevation. (A). (B. C. only).
(31) **A. pacifica** Banks. Small to large streams, cold or warm. (C).
(32) **Perla nona** Needham and Claassen. Medium-sized cold streams at low to moderate elevation. (FC). (B. C. only).

PERLODIDAE

(33) **Perlodes signata** Hagen. Vedder r. (R). (B. C. only).
(34) **Perlodes irregularis** Banks. Small to medium cold streams, at all elevations. (FC).
(35) **Isogenus** sp., cf. **frontalis** Newman. Fraser r. (A). (B.C. only).
(36) ***Hydroperla parallela** Frison. Chwk. and Nooksack r. (A); Fraser r. and Sweltzer ck. (R).

CHLOROPERLIDAE

(37) **Isoperla fulva** Claassen. Chwk. and Sumas r. (A). (B.C. only).
(38) ***Isoperla pinta** Frison. Sweltzer ck. (A); small cold cks. at low elevation. (FC to R); large rs. (R). (B. C. only).
(39) **Paraperla frontalis** Banks. Cold or warm rs. of large to moderate size, up to moderate elevations. (B. C. only).
(40) **Kathroperla perdita** Banks. Taken wherever collecting was done. (FC).
(41) **Alloperla borealis** Banks. Small cks. at low elevation. (FC).
(42) ***A. diversa** Frison. Chwk. r. (C). (B. C. only).
(43) ***A. dubia** Frison. Large to medium cold rs. at low elevation. (A).
(44) ***A. elevata** Frison. Sweltzer ck. (A); Chwk. r. (FC). (B.C. only).
(45) ***A. exquisita** Frison. Small to medium cold cks., up to fairly high elevations. (A).

(46) **A. fidelis** Banks. Small cks. at high elevation. (A). The majority of specimens collected, of both sexes, were brachypterous.
(47) **A. forcipata** Neave. Chwk. r. and Frost ck. (A). (B. C. only).
(48) ***A. fraterna** Frison. Small cks. at low elevation. (A). (B.C. only)
(49) ***A. occidens** Frison. Cks. at high elevation. (A).
(50) ***A. oregonensis** Frison. Chwk. r. (A). (B. C. only).
(51) **A. pacifica** Banks. Small to large streams at low elevation. Very abundant in Sweltzer ck.
(52) **A. serrata** Needham and Claassen. Chwk. r. (FC). (B. C. only).

THE SCALE INSECTS OF BRITISH COLUMBIA

by E. P. Venables
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The following list of scale insects is presented at this time in the hope that it may form a nucleus for a future list of a more comprehensive nature. The scale insects have received little attention in the past in British Columbia, the main object having been to exterminate or control certain species of economic importance as they appeared. Records of distribution and host plants are scarce, even with such a common species as the oyster shell scale, and although I have brought together a list of over a dozen species, there is little information regarding their occurrence outside of the Okanagan Valley.

The determination of the species in this group, excepting in the case of one or two of the commoner forms, is the particular field of the specialist who has plenty of material in various stages for comparison. The writer makes no claims in this direction, but is mainly interested in making a start in a somewhat neglected field. In the present list, notes on the distribution and habits are included, as these offer points of interest in some cases.

COCCINAE (Subfamily)

Lecanium corni Bauche
The brown apricot scale. The only specimens on hand are from broom at Vancouver.

Eulecanium coryli (L.)
The Lecanium scale. Recorded from Vancouver as a serious pest of shade trees, and recorded from alder, maple, horse chestnut, laurel, hawthorn, apple, pear, plum, cherry, beech, lime, and roses.

Pulvinaria vitis (L.)
Cottony maple scale. Vernon and Osoyoos, B. C., on cultivated maple and plum.

Saissetia oleae (Bern.)
Black scale. In Vernon infesting Abutillion shrubs.

ASTEROLECANIINAE (Subfamily)

Asterolecanium variolosum (Ratezberg)
Pit-making oak scales. Trail, B. C., on oak.

DIASPIDINAE (Subfamily)

Lepidosaphes ulmi (L.)
Oyster shell scale. Common on apple throughout most of the Interior. It has been taken on Lombardy poplar, dogwood, rose, elm, hawthorn, and willow.

Aulacaspis rosae (Bouche)
Rose scale. On wild rose bushes at Vernon; also recorded from Vancouver Island. In the Interior, infestation is confined to the lower parts of the stems, and it would appear that the insect only survives at or below snow level.

Phenacaspis pinifoliae (Fitch)
Pine leaf scale. Generally distributed and has been recorded on Douglas fir, yellow pine, Jack pine, and spruce.

Chionaspis ortholobis Comstock.
Cottonwood scale. On red dogwood at Keremeos, B. C.

Chionaspis salicis-nigrae (Walsh)
Black willow scale. Recorded by Essig as occurring in B. C. on cascara.

Aspidiotus ancylus (Putnam)
Putnam's scale. Osoyoos, B. C., on birch.

Aspidiotus ostreaeformis Curtis
Vernon, B. C., Kelowna, B. C., and Penticton, B. C. Taken on apple, prune, plum, and caragana.

Aspidiotus pini Com.
Osoyoos, B.C., and Vernon, B.C., on yellow pine.

Aspidiotus perniciosus Com.
San Jose scale. Keremeos, B.C., Osoyoos, B.C., Spences Bridge, B.C. Not at all numerous where control measures are practiced.

SOME FOOD PLANTS OF LEPIDOPTEROUS LARVAE
List No. 6

by J. R. J. Llewellyn Jones
Cobble Hill, Vancouver Island, B. C.

In presenting this sixth list of Food Plants of Lepidopterous larvae, my thanks are again due to those members of our Society who have once again been kind enough to furnish data to be included here, especially at this time to Mr. A. A. Dennys of the staff of the Dominion Entomological Laboratory at Vernon, B. C., Mr. W. Downes of the Dominion Entomological Laboratory at Victoria, and Mr. W. G. Mathers of the Dominion Entomological Laboratory at Vancouver. The initials of the person furnishing the information are placed in brackets following the record concerned.

Below is a list of abbreviations and signs used in this list:

A. A. D.—Mr. A. A. Dennys, Science Service, Dominion Department of Agriculture, Vernon, B. C.

W. D.—Mr. W. Downes, Science Service, Dominion Department of Agriculture, Victoria, B. C.

W. G. M.—Mr. W. G. Mathers, Science Service, Dominion Department of Agriculture, Vancouver, B. C.

R. G.—Mr. R. Glendenning, Science Service, Dominion Department of Agriculture, Agassiz, B. C.

G. J. S.—Professor G. J. Spencer, Department of Zoology, University of B. C., Vancouver, B. C.

J. R. J.—Mr. J. R. J. Llewellyn Jones, Cobble Hill, B. C.

An asterisk (*) denotes that the species has been mentioned before in these lists, and that the information now given is either additional, or is an amplification of what has been previously reported.

RHOPALOCERA

*Incisalia iroides Bdv. Species of Apple; attacks the young fruit. (A. A. D.)

*Papilio eurymedon Luc. Wild Cherry (**Prunus emarginata** Dougl.), Ocean Spray (**Spirea discolor** Pursh.), June Berry (**Amelanchier florida** Lindl.) (J.R.J.)

Strymon melinus atrofasciata McD. Fruit of Raspberry (W. D.)

HETEROCERA

Agnopteryx costosa Haw. Broom (wild and cultivated species) (W.D.)

Agrotis (Pseudospaelotis) haruspica inopinatus Sm. Species of Apple. (A. A. D.)

*Amphidasis (Lycia) cognataria Gn. Poplars, species of Garden Roses. (J.R.J.) Species of Apple. (A.A.D.)

Amphipyra tragopoginis L. Species of Apricot, Rose and Plum. (R.G.)

Apatela (Acronycta) fragilis fragiloides B. & Benj. Black Hawthorn (**Crataegus brevispina** Dougl.) (J.R.J.)

*Apatela (Acronycta) funeralis G. & R. Species of Apple (J.R.J.) Species of Willow (Sallow.) (A.A.D.)

Apatela (Acronycta) illita Sm. Species of Willow and Apple. (A.A.D.)

Apatela (Acronycta) perdita Grt. Saskatoon (June-berry) (**Amelanchier alnifolia** Nutt.), Species of Apple. (A.A.D.)

Autographa ampla Wlk. June-berry (**Amelanchier florida** Lindl.) (J.R.J.)

Autographa brassicae Riley. In greenhouses on Chrysanthemum and Antirrhinum. (W. D.)

Cacoesia (Archips) argyrospila Wlk., Leaf Rollers. Apple (A.A.D.)

*Cacoesia (Archips) rosaceana Harris. Leaf Rollers. Apple. (A.A.D.)

Carpocapsa (Laspeyresia) piperana Kearf. In cones of Yellow Pine (**Pinus ponderosa** Dougl.) (A.A.D.)

*Chlorosea nevadaria Pack. Alder (**Alnus rubra** Bong.) Willow. (J.R.J.)

Chrysopora lingulacella Clem. Lambs Quarters (Pig Weed) (**Chenopodium album** L.) (A.A.D.)

Datana ministra Drury. Species of Apple. (A.A.D.)

Dichomeris marginella Fabr. Irish Juniper (**Juniperus communis** Linn. var **hibernica**), Spiny Juniper (**J. communis** Linn. var **siberica**). (W. D.)

Dysstroma citrata Linn. Blackberry (**Rubus macropetallus** Dougl.) (J. R. J.)

Ectropis crepuscularia D. & S. Species of Apple. (A. A. D.)

Epinotia (Eucosma) terracoctana Wlshm. Arbutus (**Arbutus menziesii** Pursh). (W. G. M.)

***Euchlaena mollisaria** Hlst. Red Flowered Currant (**Ribes sanguineum** Pursh.), Black Hawthorn (**Crataegus brevispina** Dougl.), June-berry (**Amelanchier florida** Lindl.), Blackberry (**Rubus macropetallus** Dougl.), Willows (**Salix hookeriana** Barr. & **Salix scouleriana** (Hook.) Barr.) (J.R.J.)

Graptolitha torrida Sm. Species of Apple. Larvae will feed upon the young fruit. (A. A. D.)

***Halisidota argentata** Pack. Species of Spruce (**Picea**). (A. A. D.)

Heliothis phloxiphaga G. & R. Antirrhinum & Schizanthus including the seed pods. (W. D.)

Hemerocampa pseudotsugata McD. Douglas Fir (**Pseudotsuga mucronata** (Raf.) Sudw.), Western White Fir (Balsam) (**Abies grandis** Lindl.), Hemlock (**Tsuga heterophylla** (Raf.) Sarg.). (J.R.J.)

Hemerophila pariana Clerck. Species of Apple, Pear, Sweet Cherry, and Mountain Ash (**Sorbus aucuparia.**). (W. D.)

Hyphantria cunea Drury. Apple, Choke Cherry (**Prunus demissa** Nutt.) (A. A. D.))

Laspeyresia (Enarmonia) prunivora Walsh. Species of Apple (A.A.D.)

Lyonetia speculella Clem. Mines in leaves of Apple. (A. A. D.)

Malacosoma americana Fabr. Apple and probably Willow. (A. A. D.)

***Malacosoma disstria** Hbn. Species of Apple. (A. A. D.)

Malacosoma fragilis Stretch. Species of Apple. (A. A. D.)

Marmara arbutiella Busck. Mines in leaves of Arbutus (**A. menziesii** Pursh.) (W. G. M.)

Ocnerostoma piniariella Zeller. Mines needles of White Pine (**Pinus monticola** Dougl.) (W. G. M.)

***Orthosia hibisci** Gn. Species of Apple. (A. A. D.)

Parastichtis purpurea antapica Sm. Red Flowered Currant (**Ribes sanguineum** Pursh.), Alder (**Alnus rubra** Bong.), Bird Cherry (**Nutallia cerasiformis** T. & G.), Wild Cherry (**Prunus emarginata** Dougl.), June-berry (**Amelanchier florida** Lindl.), Species of Rose. (J. R. J.)

Phlyctaena itysalis tillialis Dyar. In stems of Thistles. (J. R. J.)

Plutella maculipennis Curt. Ball mustard. (G. J. S.)

Polia lubens (lutra)**glaucopis** Hampson. Lodgepole Pine. (**Pinus contorta** Dougl.) (W. G. M.)

***Rachela occidentalis** Hlst. June-berry (**Amelanchier florida** Lindl.), Snow-berry (**Symphoricarpus racemosus** Michx.), Maple (**Acer macrophyllum** Pursh.) (J. R. J.)

***Synaxis jubararia** Hlst. Species of Poplar. (J. R. J.)

Tortrix citrana Fern. In greenhouses on species of Rose, Cyclamen, Tomato, and Asparagus Fern. (W. D.)

Zale minerea norda Sm. Species of Apple. Foliage is preferred but larva will eat the fruit. (A. A. D.)

Zeiraphera (**Enarmonia**) **ratzeburgiana** Sax. Sitka Spruce (**Picea sitchensis** (Bong.) Carr.) (W. G. M.)

PHENOMENAL INFESTATION OF ECTOPARASITES ON MARMOT, WEASEL & PACKRAT

by George P. Holland
Science Service, Dominion Department of Agriculture

The groundhogs or yellow-bellied marmots, **Marmota flaviventris avara** (Bangs) of the Kamloops district, normally have a short season of activity, coming out of hibernation in March and retiring again in late August or early September. However, in October, 1937, a single specimen was seen actively running over the rocks by the road near Tranquille, B.C., and on November 17th, another was found moving sluggishly over the snow in the same locality. This animal, a young female of the year, judging from its size, was captured and placed in a

cage at the Dominion Entomological Branch Field Laboratory at Kamloops. It was noted that the creature was in very poor physical condition, having wasted away to little more than skin and bone, and also that the tail, limbs and under parts were very mangy. T. K. Moillier, formerly connected with the Kamloops Laboratory, found a similar mangy groundhog dragging itself weakly over the ground near Mount Olie, B. C., on November 27th, 1933. This animal had been practically denuded, especially on the tail and limbs, and the little hair remaining was thickly infested with fleas. A few nymphal ticks, **Dermacentor andersoni** Stiles also were feeding on it.

Our groundhog drank a little milk but refused all solid food during its period of captivity, which was terminated on November 23rd, 1937, by its death. When checked for the presence of ectoparasites it was found to be literally seething with fleas and lice (Fig. 1). During the next two days a good deal of time was spent in picking off these creatures until about 150 fleas and 9.75 c.c.'s of concentrated lice had been collected. Taking into consideration the facts that a goodly portion of its parasite population had already dropped off into the bedding material, as the animal was cold and stiff when found dead in its cage, and also that thousands of lice were still clinging tenaciously to the pelage when the specimen was ultimately discarded, the original population may be conservatively estimated to have been about 250 fleas and 50,000 lice. This terrific infestation undoubtedly had driven the miserable creature from its hibernating quarters, and by dint of sheer numbers had so sapped its strength as to bring about its death.

Professor G. J. Spencer of the University of British Columbia has kindly identified the **Anoplura** as **Neohaematopinus marmotae** Ferris 1923, and the fleas as **Thrassis acamantis** Roths, 1905.

A further remarkable circumstance in connection with this case is that the flea larvae were found actually living on the host. Several dozen, large and small, were picked off and preserved. This is a most unusual association as flea larvae are almost invariably found only in the bedding material.

Other cases of this nature have come to our attention. A weasel, **Mustela arizonensis** (Mearns) taken at Kamloops on October 12th, 1937, was found to be infested with the larvae of fleas as well as the adults. These were **Orchopeas caedens durus** Jordan. A packrat, **Neotoma cinerea occidentalis** (Baird) captured alive at Mount Dunn on August 12th, 1937, and which died at Kamloops on December 14th, 1937, was in a similar condition, about three dozen mature fleas and half this number of larvae being found in the fur upon examination. These fleas were identified as **Orchopeas sexdentatus agilis** Roths. Unfortunately none of the larvae was reared through. The adult fleas from the weasel and packrat were determined by Dr. M. A. Stewart of the University of California at Davis.

Notes on the Occurrence of GRYLLOBLATTA CAMPODEIFORMIS Walker in the Kalmoops District

by J. D. Gregson
Science Service, Dominion Department of Agriculture

The recent captures of specimens of **Grylloblatta campodeiformis** Walker at Kamloops have created a widespread interest among both laymen and entomologists. Discovered originally in 1913 at Banff, Alberta, by Dr. E. M. Walker, the insect was then, and still is, recognized as a purely high altitude inhabitant, and although apparently quite widespread in distribution, specimens have rarely been found at elevations below 5,000 feet. Indeed, its close association with cold mountain streams, melting snow, and glaciers is responsible for its popular name of "Ice-bug".

The recent discovery of **Grylloblatta** in the dry belt of British Columbia at the low elevation of 1,400 feet tends to modify all preconceived ideas with regard to the environment and biology of these creatures. Given a suitable refuge from the heat of the summer sun, the insects apparently are able to thrive readily in an extremely hot and dry climate at a relatively low altitude. The fact that they abound in an area only half a mile from the city of Kamloops provides the opportunity for studies that have hitherto been curtailed because of the inaccessibility of their environment during winter months.

The first Kamloops specimen[1] was taken by the writer on November 14, 1936, from beneath a rock on the talus slope of Mt. St. Paul. A heavy snowfall prevented further search till February 26th, 1937, when the slope was carefully scoured but without success. Several subsequent collecting trips during the summer all failed to produce further specimens.

On December 29th, 1937, the writer again visited the area, and was fortunate in securing three small nymphs. Another trip the next day yielded six more specimens. Since then, numerous searches made by members of the Dominion Entomological Branch and by interested residents and school students of Kamloops have led to the captures of many "Ice-bugs", varying in stages of development from minute nymphs to adults almost an inch long.

All Kamloops specimens of **Grylloblatta** have been taken on the southern exposure of Mt. St. Paul. This mountain rises from 1,200 feet to 2,700, and is faced on the south with rocky bluffs and a deep talus slope. The cliffs are of exceedingly crumbly volcanic rock and are fissured with cracks that probably extend inward for many feet. From the bases of these prominences the fallen rocks lie in steep slides of coarse debris for distances of over a thousand feet towards the bottom. The lower and surrounding slopes are covered with material of a clayey texture, maintaining a sparse vegetation of sage and bunchgrass.

The first few captures of the insect were made on one of the lower

[1]This specimen was kindly determined by Prof. G. J. Spencer and verified by Dr. E. M. Walker.

bluffs. Specimens could be found at the rate of about two an hour in moss and gravel adjoining solid rock, and beneath slabs of weather-loosened material. Since then, many have been found in damp humus beneath rocks slightly within the margin of the talus slope, and one adult was taken from beneath a large boulder some fifty feet up the slide.

The winter food of **Grylloblatta** appears to be hibernating moths, ladybirds, wasps, spiders, and bugs; all of which appear in profusion in crevices between the solid rock. Active **thysanura** and **collembola** probably also contribute to their diet. In one instance a large "Ice-bug" was disturbed while busily devouring an already half-eaten moth. Specimens in captivity feed very readily on cockroaches.

All specimens observed appeared to be most active at temperatures slightly above freezing. One agile nymph was found in a crevice between a sheet of ice and rock. The insects certainly show a partiality towards cold, die very soon if kept at room temperature, and show an immediate heat prostration if placed on one's hand. These observations are in keeping with the experiments of Mills and Pepper[2], where it is shown that the optimum condition for Montana specimens is 3.7 degrees C. The cold and heat prostration temperatures are stated to -6.2 and 27.8 degrees C., respectively. These data would imply that at Kamloops the **Grylloblatta** appear near the surface of the slides only while the outside temperature is in the neighborhood of zero degrees centigrade. As the temperature rises or falls beyond their optimum they most likely seek shelter in rock crevices remote from the surface. Just how far they have to penerate to avoid the summer heat, and what they live on during the greater part of the year are questions that arouse interesting speculations. Certainly the southern slope of Mt. St. Paul must become one of the hottest areas in British Columbia during a midsummer day when the temperature often reaches over a hundred in the shade.

Although several expeditions have been made to other rocky outcroppings in the North Thompson Valley, and bordering Kamloops Lake, careful searches have to date exposed no other specimens of **Grylloblattids.** None of these areas possessed slides of loose rock to the extent of those on Mt. St. Paul, and in many cases the rock was mixed with a certain amount of clay. Because of the relatively slight depth to which an insect might penetrate in these slides, compared to the talus slopes of their described habitat, it is quite possible that the latter area is one of the few places in the dry belt where the "Ice-bug" has been able to maintain its existence. In any event, whether this ice-loving insect should or should not prove to be present in other parts of the dry belt of British Columbia, the fact that this creature has been found in an area surrounded by cactus plants and other xerophytic vegetation raises questions that constitute an interesting biological problem.

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[2]Mills and Pepper. Annals of Ent. Soc. of Amer., Vol. XXX, No. 2, pp. 269-274, 1937.

ENTOMOLOGICAL SOCIETY OF BRITISH COLUMBIA
REPORT OF THE SECRETARY-TREASURER

For the Year Ending February 26, 1938

Herewith, I beg to submit this report of the activities of this Society for the past year.

Finances

The present bank balance, as indicated and audited is $176.10. Publication of No. 34 has not yet been paid for. This will amount to slightly over $200.00 which, as you see, will not be covered by the present balance. To make up the difference it is proposed to ask the contributors of articles to pay ten cents apiece for reprints and for members to pay for any cuts which appear in their articles. If this is done it would about make up the cost of the present publication and leave fees for this year and the government grant to cover the cost of the next issue.

I am pleased to state that donations to the reserve fund amounted to $21.00 during the year. Four members contributed 10, 8, 2, and 1 dollars respectively. It is suggested that more of the members follow this example.

Proceedings

As you have noted, the present number 34 of the Proceedings has been placed in your hands at this meeting. Considering that there has been a change of printers and that the present printers had never handled an entomological publication before, the work seems very creditable.

Membership

There has been a slow but steady growth of membership during the past three years, and it now stands at 55. I have no doubt that by the end of the present meeting, at least ten new members will have been added.

Library

Recently, four very fine volumes have been presented to us by the Trustees of the British Museum as follows:

1. **Bombyliidae** of Palestine by E. E. Austen.
2. African **Ceratina, Halictus,** and **Megachile** by T. D. A. Cockerell.
3. A Catalogue of the African **Hesperiidae** by W. H. Evans.
4. A Monograph of the **Pierine** Genus **Delias** by G. Talbot.

In addition to the above, a great many exchanges are maintained including The Lingnan Science Journal; Review of Applied Entomology; American Museum of Natural History; U. S. National Museum; Annals of the Museum of Zoology, Poland; Wanderversammlung Deutscher Entomologen, Berlin; Opuscula Entomologica, Lund, Sweden; U.S.S.R. publications from Moscow; and many colleges and universities in the United States.

Reserve Fund

The reserve fund now totals $76.00. Let us hope it may be pushed over the hundred mark during the coming year.

GEO. R. HOPPING,
Secretary-Treasurer.

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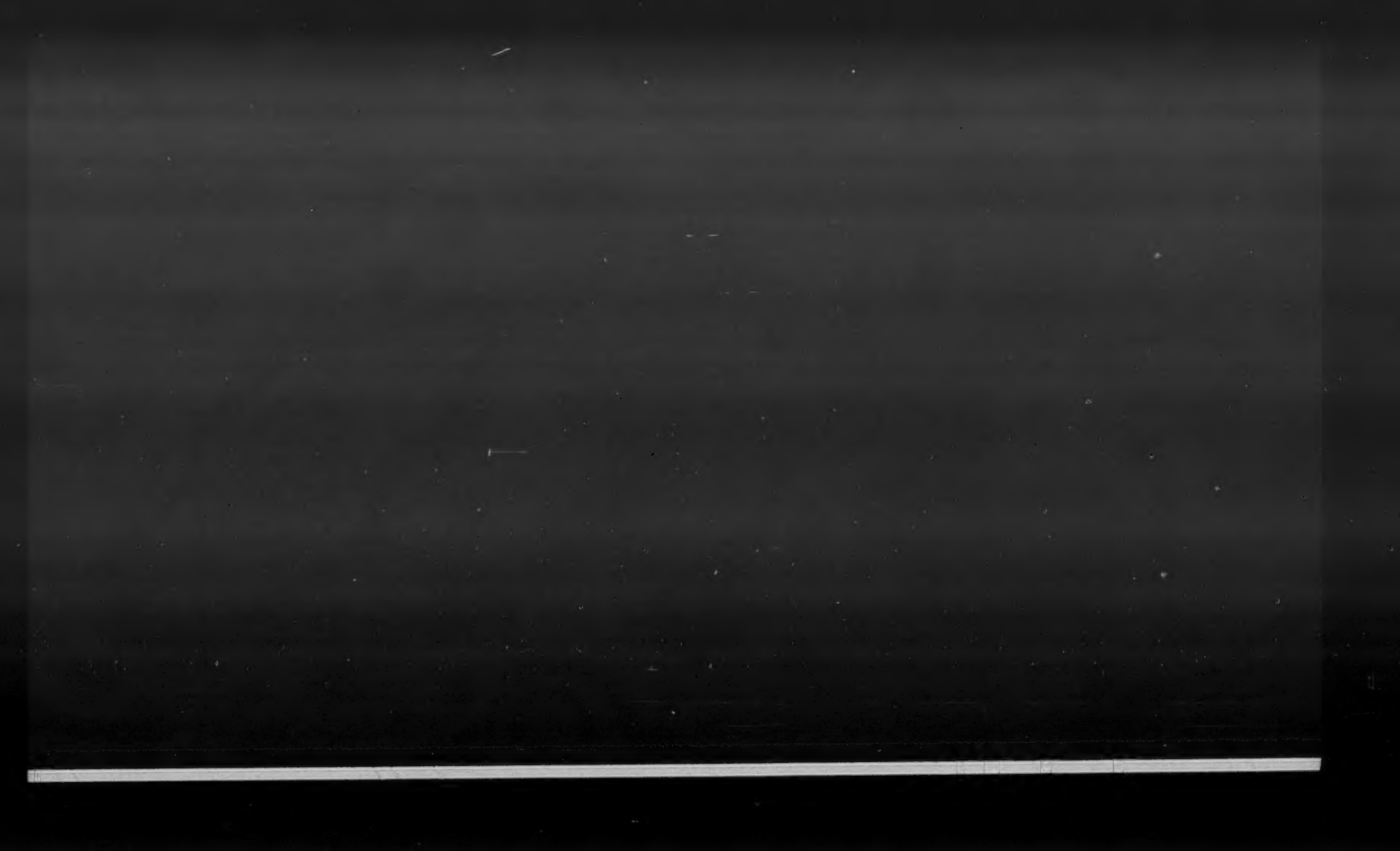
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